

## CLAIMS

What is claimed is:

1. A method for making an electronic circuit assembly, comprising the steps of:

(a) providing a precircuit comprising:

(i) a metallic sheet made of a first metal and having a top surface and a bottom surface;

(ii) a first conductor pattern attached to the bottom surface of the metallic sheet and made of a second metal, wherein the first conductor pattern comprises:

(A) a base pad having a first predetermined size and shape and a base pad perimeter thereabout,

(B) a circuit trace, and

(C) first and second pedestal pads disposed proximate the circuit trace on opposite sides thereof;

(iii) a second conductor pattern attached to the top surface of the metallic sheet and made of a third metal, wherein the second conductor pattern comprises:

(A) a plurality of masking pads arranged generally within the base pad perimeter, wherein each masking pad has a second predetermined size and shape smaller than the base pad, and

(B) a bridging element having first and second enlarged ends and a constricted portion therebetween, the bridging element being oriented generally transverse to the circuit trace with each enlarged end disposed opposite a respective one of the pedestal pads; and

(iv) a substrate having an electrically insulative surface to which the first conductor pattern is attached;

(b) etching the precircuit in an etchant which etches substantially only the first metal, so as to form undercuts in the metallic sheet directly beneath the masking pads; and

35 (c) continuing to etch the precircuit and undercut the masking pads to create a circuit,

(i) such that the metallic sheet beneath each masking pad is substantially completely undercut causing the masking pads to detach from the metallic sheet, thereby  
40 providing a plurality of bumps made of the first metal disposed atop the base pad generally within the base pad perimeter,

(ii) wherein a pedestal made of the first metal is formed between each pedestal pad and its respective  
45 enlarged end of the bridging element, thereby providing an air bridge crossover above the circuit trace.

2. A method according to claim 1, wherein the second and third metals are the same metal.

3. A method according to claim 1, wherein the first metal is aluminum and the second and third metals are copper.

4. A method according to claim 1, wherein the plurality of bumps is distributed generally evenly across substantially all of the base pad.

5. A method according to claim 4, further comprising the step of:

(d1) wirebonding an end of a wirebond wire to the plurality of bumps atop the base pad.

6. A method according to claim 1, wherein the first conductor pattern includes at least two base pads to which a surface mount electronic component may be soldered and wherein the second conductor pattern includes a plurality of masking pads for each of the at least two base pads, wherein each plurality of bumps for the at least two base pads is arranged proximate an edge of its respective base pad within a projected footprint of the surface mount electronic component.

7. A method according to claim 6, further comprising the steps of:

(d2) placing the surface mount electronic component atop the at least two base pads such that a termination of the component rests generally atop each plurality of bumps atop its respective base pad; and

(e) soldering each component termination to its respective base pad, such that each plurality of bumps is generally enclosed within a solder joint connecting each component termination with its respective base pad.

8. A method for making an electronic circuit assembly, comprising the steps of:

(a) providing a precircuit comprising:

(i) a metallic sheet made of a first metal and having a top surface and a bottom surface;

(ii) a first conductor pattern attached to the bottom surface of the metallic sheet and made of a second metal, wherein the first conductor pattern comprises:

(A) a plurality of base pads each having a first predetermined size and shape and a base pad perimeter thereabout,

(B) a circuit trace, and

(C) first and second pedestal pads disposed proximate the circuit trace on opposite sides thereof;

(iii) a second conductor pattern attached to the top surface of the metallic sheet and made of a third metal, wherein the second conductor pattern comprises:

20       (A) a masking pad generally centered opposite each base pad, each masking pad having a second predetermined size and shape generally congruent in size with the first predetermined size and shape of its respective base pad, and

25       (B) a bridging element having first and second enlarged ends and a constricted portion therebetween, the bridging element being oriented generally transverse to the circuit trace with each enlarged end disposed opposite a respective one of the pedestal pads; and

30       (iv) a substrate having an electrically insulative surface to which the first conductor pattern is attached;

35       (b) etching the precircuit in an etchant which etches substantially only the first metal, so as to form undercuts in the metallic sheet directly beneath the masking pads; and

      (c) continuing to etch the precircuit and undercut the masking pads to create a circuit,

40       (i) such that the metallic sheet beneath each masking pad is substantially completely undercut causing the masking pads to detach from the metallic sheet, thereby providing a plurality of bumps made of the first metal, each bump being disposed atop a respective one of the base pads,

45       (ii) wherein a pedestal made of the first metal is formed between each pedestal pad and its respective enlarged end of the bridging element, thereby providing an air bridge crossover above the circuit trace.

9. A method according to claim

8, wherein the bumps are disposed generally about a projected footprint of a surface mount electronic component.

10. A method according to claim 9, further comprising the steps of:

attaching the surface mount electronic component to the circuit amid the bumps, wherein the component has I/O  
5 bond pads arranged on a top surface thereof; and

attaching a wirebond wire between each I/O bond pad and a respective bump.

11. A method according to claim

8, wherein the bumps are disposed generally within a projected footprint of a surface mount electronic component in matched relation with a plurality of respective I/O bond pads on a face of the  
5 component.

12. A method according to claim 11, further comprising the steps of:

orienting the electronic component such that each I/O bond pad rests atop a respective one of the bumps; and  
5 simultaneously bonding each I/O bond pad to its respective bump.

13. A method according to claim

8, wherein the first conductor pattern further includes two mounting pads to which a surface mount electronic component may be soldered, such that the bumps are disposed generally between the two mounting pads and generally within a  
5 projected footprint of the surface mount electronic component.

14. A method according to claim 13, further comprising the steps of:

orienting the electronic component such that a body  
portion thereof rests atop the bumps with a termination of  
5 the component registered atop each of the two mounting  
pads; and

soldering each component termination to its respective  
mounting pad.

15. A method according to claim  
8, wherein the second and third metals are the same metal.

16. A method according to claim  
8, wherein the first metal is aluminum and the second and  
third metals are copper.

17. A method for making an electronic circuit assembly,  
comprising the steps of:

(a) providing a precircuit comprising:

5 (i) a metallic sheet made of a first metal and  
having a top surface and a bottom surface;  
(ii) a first conductor pattern attached to the bottom  
surface of the metallic sheet and made of a second  
metal, wherein the first conductor pattern comprises:

10 (A) a base pad having a first predetermined size  
and shape and a base pad perimeter thereabout,

(B) a circuit trace, and

(C) first and second pedestal pads disposed  
proximate the circuit trace on opposite sides  
thereof;

15 (iii) a second conductor pattern attached to the top  
surface of the metallic sheet and made of a third  
metal, wherein the second conductor pattern comprises:

20 a bridging element having first and second  
enlarged ends and a constricted portion  
therebetween, the bridging element being  
oriented generally transverse to the circuit

trace with each enlarged end disposed opposite a  
respective one of the pedestal pads; and

(iv) a substrate having an electrically insulative  
25 surface to which the first conductor pattern is  
attached;

(b) attaching at least one masking pad to the top surface  
of the metallic sheet generally within the base pad  
perimeter, wherein each masking pad has a second  
30 predetermined size and shape and is made of a masking  
material which may be stripped without significantly  
attacking the first, second, and third metals;

(c) etching the precircuit in an etchant which etches  
substantially only the first metal, so as to form a circuit  
35 having,

(i) a plurality of bumps made of the first metal,  
each bump being disposed beneath a respective one of  
the masking pads, and

(ii) a pedestal made of the first metal formed between  
40 each pedestal pad and its respective enlarged end of  
the bridging element, thus providing an air bridge  
crossover above the circuit trace; and

(d) stripping the masking pads from the circuit, thereby  
exposing the bumps.

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18. A method according to claim 17, wherein the first  
metal is aluminum and the second and third metals are  
copper.

19. A method for making an electronic circuit assembly,  
comprising the steps of:

(a) providing a precircuit comprising:

(i) a metallic sheet made of a first metal and  
5 having a top surface and a bottom surface;

(ii) a first conductor pattern attached to the bottom surface of the metallic sheet and made of a second metal, wherein the first conductor pattern comprises:

- (A) a base pad having a first predetermined size and shape and a base pad perimeter thereabout,
- (B) a circuit trace, and
- (C) first and second pedestal pads disposed proximate the circuit trace on opposite sides thereof;

(iii) a second conductor pattern attached to the top surface of the metallic sheet and made of a third metal, wherein the second conductor pattern comprises:

- (A) at least one masking pad arranged generally within the base pad perimeter, wherein each masking pad has a second predetermined size and shape, and
- (B) a bridging element having first and second enlarged ends and a constricted portion therebetween, the bridging element being oriented generally transverse to the circuit trace with each enlarged end disposed opposite a respective one of the pedestal pads; and

(iv) a substrate having an electrically insulative surface to which the first conductor pattern is attached;

(b) etching the precircuit in an etchant which etches substantially only the first metal, so as to form a circuit having,

- (i) a plurality of bumps made of the first metal, each bump being disposed beneath a respective one of the masking pads, and
- (ii) a pedestal made of the first metal formed between each pedestal pad and its respective enlarged end of the bridging element, thus providing an air bridge crossover above the circuit trace; and



(c) selectively etching away only the masking pads, thereby exposing the bumps.

20. A method according to claim 19, wherein the first metal is aluminum and the second and third metals are copper.

21. An electronic circuit assembly for connecting an electronic component thereto, comprising:

an electrically insulative substrate;

at least two mounting pads disposed on said substrate  
5 in matched relation with respective terminations of the electronic component; and

at least one metallic bump attached to each mounting pad within a projected footprint of the electronic component.

22. An electronic circuit assembly according to claim 21, wherein said at least one bump on each mounting pad is/are arranged generally symmetrically thereon with respect to a central longitudinal axis of said projected footprint.

23. An electronic circuit assembly according to claim 21, wherein said mounting pads are made of a first metal and said metallic bumps are made of a second metal.

24. An electronic circuit assembly according to claim 23, wherein said first metal is copper and said second metal is aluminum.

25. An electronic circuit and component assembly, comprising:

an electrically insulative substrate;

at least two mounting pads arranged on said substrate;

5 at least one metallic bump attached to a top surface of each mounting pad;

an electronic component having at least two terminations thereon, said component being disposed such that each termination rests atop a respective one of said mounting pads in contact with said at least one metallic bump atop each pad; and

a joint of electrically conductive bonding material connecting each termination with a respective one of said mounting pads.

26. An electronic circuit assembly according to claim 25, wherein said mounting pads are made of copper and said bumps are made of aluminum.

27. An electronic circuit assembly according to claim 25, wherein said bonding material is solder or electrically conductive adhesive.